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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/759,885	01/15/2004	Edward W. Sheridan	EM- 1989	8465
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EXAMINER SAVAGE, JASON L				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/759,885

**Applicant(s)**

SHERIDAN ET AL.

**Examiner**

JASON L. SAVAGE

**Art Unit**

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**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 March 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1, 3-8 and 10-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3-8 and 10-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-8508)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3-20-08 has been entered.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 3-8 and 10-17 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The limitation that the layers in combination... 'maximize the liberation of a gaseous reaction product' in lines 8-9 of claim 1 is not described in the specification or claims as originally filed and is considered new matter. While there are multiple references to the formation and liberation of a gaseous reaction product such as on page 4, lines 11-12, line 22 and page 5, line 22, there are no disclosures that the liberation of a gaseous reaction product is maximized.

***Claim Rejections - 35 USC § 102/103***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-4, 6-7, 10, 12-13, 15 and 17 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Danen et al. (US 5,266,132).

Danen teaches an energetic material comprising a plurality of layers **A** and a plurality of layers of materials **B** which are reactive with one another wherein the layers have thicknesses from between 1-1000 nm (col. 2, In. 16-68 and Figure 1) which anticipates the range of the layer thickness being less than or equal to approximately 10 nm. Danen further teaches that the layers may comprise various metal materials not in oxide form including an aluminum hydride adduct and a layer of material of oxide form such as CuO (col. 5, In. 25-44).

Regarding the limitations that one of the layers containing a metal substantially not in oxide form comprise a composition selected from metal hydrides or interstitial

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hydrogen, the aluminum hydride adduct of Danen would meet the limitation of the layer comprising a metal hydride as it is a hydride with metal aluminum. In the alternative, the claim limitation would have been obvious.

Regarding the limitation that the layers in combination maximize the liberation of a gaseous reaction product, Danen teaches that such an energetic material is expected to produce large volumes of high temperature gas and that the energy release can be optimized to be released as thermal with release of large quantities of gas (col. 5, In. 36 – col. 6, In. 17).

Regarding the limitation that the layers in combination reduce diffusion flux, as disclosed by Applicant in the specification on page 5, lines 1-4, the present invention provides a reduction in diffusion flux due to the reduced cross sectional area of the layers compared to prior art layers which are microns or greater in thickness. Since Danen teaches the same materials as claimed and layers thicknesses within the claimed range, one would expect the diffusion flux to be reduced such as is claimed.

Regarding claims 3-4 and 6, the energetic materials of Danen comprise a plurality of the recited materials not in oxide form and materials in oxide form (col. 2, In. 23-42).

Regarding claims 7 and 10, Danen teaches that the reacting materials may include hydrides of aluminum (col. 5, In. 9-44).

Regarding claim 12, the sputtering deposition of Danen (col. 3, In. 43-62) would result in the same composite as that claimed by Applicant.

Regarding claim 13, Danen teaches composite may be formed on any conventional substrate material including those claimed by Applicant (col. 4, In. 20-30).

Regarding claim 15, Danen teaches the same energetic material structure as that claimed by Applicant. Furthermore, Danen teaches the composite is suitable for use in explosive applications (col. 1, In. 9-15). As such, one would expect that energetic fragments would form upon detonation just as that claimed by Applicant.

Regarding claim 17, the energetic material of Danen would be just as suitable for use in an anti-tamper device as the energetic device claimed since Danen teaches the same structure which is claimed.

#### ***Claim Rejections - 35 USC § 103***

Claims 5, 8, 11, 14 and 18-21 are rejected under 35 U.S.C. 103(a) as obvious over Danen et al. (US 5,266,132).

Regarding claim 8, although Danen does not exemplify an embodiment containing a layer of metal hydride and an oxide layer of the claimed materials, it teaches the oxide materials may include Fe (col. 5, In. 9-44). It would have been obvious to one of ordinary skill in the art to have used an oxide of Fe since Danen teaches it as being a suitable material.

Regarding 18-19 and 21, Danen teaches what is set forth above however it does not exemplify an embodiment wherein a first layer comprising metal hydrides is disposed next or adjacent to a layer of second material comprising metals in oxide form. However, Danen teaches a material comprising layers of a first material Al, a second

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material CuO and a third material of a metal hydride adduct with buffer layers of alumina disposed between each layer (col. 5, ln. 36-44). Danen further teaches that the composite may have layers in a variety of sequences such as the sequence AbBbCbAbBCb etc (col. 2, ln. 36-42). It would have been obvious to one of ordinary skill in the art to have formed a material including adjacent layers BC wherein one layer is a metal hydride such as the aluminum hydride adduct and the other layer is in oxide form such as CuO with a reasonable expectation of success since Danen teaches that CuO and the aluminum hydride adduct are to react with one another. The recited embodiment would meet the claim limitation wherein said first layer of metal hydride material is deposited/disposed next to at least one of said second layer of material in oxide form.

Furthermore, Danen teaches the energetic material may be formed by a layer of one reactant being laid down upon the other (2 layer system) although the two layers would partially react forming a self-buffering layer between them (col. 3, ln. 1-4 and 26-33). As such, it would have been within the purview of one of ordinary skill in the art to have formed a two material layer system with a reasonable expectation of success. One of ordinary skill would have been motivated to have selected a metal hydride material and metal oxide material for the layer material in order to produce large quantities of gas after reaction is initiated.

Regarding claim 5 which recites that a plurality of layers not in oxide form is adjacent to at least one of the plurality of layers substantially in oxide form, the recited

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two layer system described above comprising a metal hydride material and metal oxide material would meet the claim limitations.

Regarding claims 11 and 20, although Danen is silent to the use of interstitial hydrogen, Danen teaches the use of metal hydrides such as aluminum hydride. It would have been within the purview of one of ordinary skill in the art at the time of the invention to have recognized that alternate material compositions including metals with interstitial hydrogen could be employed with a reasonable expectation of success of forming an energetic material capable of producing large volumes of high temperature gas. Absent a teaching of the criticality or showing of unexpected results of the layer comprising a metal with interstitial hydrogen instead of a metal hydride, it would not provide a patentable distinction over the prior art.

Regarding claim 14, Danen teaches the composite is suitable for use in explosive applications (col. 1, ln. 9-15). As such, it would have been obvious to one of ordinary skill in the art to have employed energetic materials typically employed in explosive applications such as those claimed into the energetic material of Danen with a reasonable expectation of success.

#### ***Allowable Subject Matter***

Claim 16 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.



The prior art teaches what is set forth above however it is silent to the material comprising materials of Mn and P and thus would not meet the limitation claimed of forming energetic fragments of the claimed elements.

### ***Response to Arguments***

Applicant's arguments filed 3-20-08 have been fully considered but they are not persuasive.

#### Claim Objection

The claim objections have been overcome.

#### Claim Rejections – 35 USC 112

As recited in the rejection above, the limitation to 'maximize the liberation of a gaseous reaction product' is considered new matter.

#### Claim Rejections – 35 USC 103(a)

Regarding the claim rejections under 35 USC 103 to Danen, Applicant argues on page 7 of the Amendment that the aluminum hydride trimethylamine adduct is an organic aluminum compound and not a metal comprising a metal hydride. This argument is not persuasive as the aluminum hydride adduct of Danen is considered to meet the limitation of the layer comprising a metal hydride since it is a hydride with metal aluminum. In the alternative, the claim limitation would have been obvious.

Applicant further argues on pages 7-8 of the Amendment that Danen does not teach, anticipate or infer the optimization of hydrogen or any other part of Applicant's invention. This argument is not persuasive since Danen teaches the energetic material may be designed to produce large volumes of gas.

Applicant asserts on page 8 of the Amendment that one skilled in the art would recognize that the first Al and second CuO layers in the three layer embodiment of Danen are intended to provide the thermal energy necessary to drive the decomposition and subsequent oxidation of the third hydride adduct containing layer. Applicant further argues that the present disclosure is fundamentally a different form in that it teaches only two layer systems are necessary to be a gas former. However, these arguments are not commensurate in scope with the claims as none of the claims are limited to a two layer system.

More specifically, claims 1, 3-4, 6-8 and 10-17 have no limitation on the relative positioning of the first and second layer. As such, whether an extra layer of Al is necessary to drive the reaction between the CuO and aluminum hydride adduct layer such as asserted by Applicant, the embodiment of Danen would still meet the claim limitations.

Regarding claims 18-21 which have limitations reciting a first metal hydride containing layer is disposed next or adjacent to a second oxide containing layer, Danen does not exemplify the claimed embodiments. However, as set forth in the rejections above, Danen teaches that layers may be disposed adjacent to each other without an intervening buffer layer such as described in the sequence which recites BC adjacent

layers (col. 2, ln. 36-41). Such a sequence would meet the limitation that a first layer is disposed next to at least one (emphasis added) second layer.

Regarding claim 5 and embodiments which would require a plurality of first layers being adjacent to a plurality of second layer materials, as recited in the rejections above Danen teaches two layer systems which would meet the claim limitations.

Applicant further argues on page 8 of the Amendment that the energetic material would not result in a self-propagation reaction. This argument is not commensurate in scope with the claims. Furthermore, contrary to Applicant's assertion Danen teaches that the reaction is self-propagating and that after reaction is initiated, the reaction of a first pair of reactive layers will cause other layers to react (col. 4, ln. 31-37).

Applicant's argues that a reaction in the enegertic material of Danen requires triggering by an external agent which is a distinguishable and critical difference between Applicant's invention and Danen. This argument is not commensurate in scope with the claims. Furthermore, one would expect Applicant's energetic material would need an external trigger to cause the reaction to initiate as well otherwise the material would detonate upon formation.

Applicant also argues that the language "and hydrides thereof" does not appear in the referenced patent and is not taught, anticipated or inferred. As described above, Dannen teaches the claimed reacting metals. Danen further teaches a hydride of the metals which is aluminum hydride. As such, Dannen is viewed as teaching the claimed metals and hydrides of the metals.

***Related Prior Art***

The following is a listing of prior art which is deemed pertinent to the present invention:

Nielson et al (US 6,224,099) teaches energetic materials comprising metal materials including hydrides and oxidizing materials including materials such as RDX (col. 3, ln. 50-67).

Hinshaw et al. (US 5,439,537) teaches an energetic material comprising metal material and an oxidizing agent to form oxide portions. Hinshaw further teaches that hydrides of the metal may be employed in the energetic material (col. 3, ln. 25-48).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JASON L. SAVAGE whose telephone number is (571)272-1542. The examiner can normally be reached on M-F 6:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Keith Hendricks can be reached on 571-272-1401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jason Savage/  
3-27-08

/KEITH D. HENDRICKS/  
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